CLAIMS

We claim:

1. A coating composition curable upon exposure to both UV radiation and thermal energy, the composition comprising

(a1) a radiation curable component which polymerizes upon exposure to UV radiation, comprising

(a11) at least two functional groups comprising at least one bond activatable upon exposure to UV radiation, and

(a12) one or more isocyanate-reactive functional groups,

(a2) a thermally curable binder component which polymerizes upon exposure to heat, consisting of one or more oligomers or polymers having

(a21) at least two isocyanate-reactive functional groups, and

(a22) substantially no functional groups having bonds activatable upon exposure to UV radiation, and

(a3) a thermally curable crosslinking component comprising at least 2.0 isocyanate groups per molecule,

wherein the ratio of NCO groups to the sum of isocyanate-reactive functional groups (a12) and (a21) is less than 1.30.

2. The coating composition of claim 1, wherein the ratio of NCO groups to the sum of isocyanate-reactive functional groups (a12) and (a21) is from 0.50 to 1.25.

3. The coating composition of claim 2 wherein the ratio of NCO groups to the sum of isocyanate-reactive functional groups (a12) and (a21) is from 0.75 to 1.10.

4. The coating composition of claim 1 wherein the ratio of NCO groups to the sum of isocyanate-reactive functional groups (a12) and (a21) is less than 1.00.

Sub A1 cont.

5. The coating composition of claim 3 wherein the ratio of NCO groups to the sum of isocyanate-reactive functional groups (a12) and (a21) is from 0.75 to 1.00.

6. The coating composition of claim 1 wherein isocyanate-reactive functional groups (a12) and (a21) are hydroxyl groups.

7. The coating composition of claim 1wherein the thermally curable binder component (a2) has a polydispersity of less than 4.0.

8. The coating composition of claim 7 wherein the thermally curable binder component (a2) has a polydispersity of less than 3.5.

9. The coating composition of claim 8 wherein the thermally curable binder component (a2) has a polydispersity of from 1.5 to less than 3.5.

10. The coating composition of claim 9 wherein the thermally curable binder component (a2) has a polydispersity of from 1.75 to less than 3.0.

11. The coating composition of claim 1 wherein the thermally curable binder component (a2) is selected from the group consisting of polyesters, epoxy functional materials, acrylics, and mixtures thereof.

12. The coating composition of claim 7 wherein thermally curable binder component (a2) is a polyester.

13. The coating composition of claim 1 wherein thermally curable binder component (a2) has no more than 5% by of aromatic ring structures, based on the nonvolatile weight of thermally curable binder component (a2).

14.. A method of making a coated substrate, comprising applying the coating composition of claim 1 to a substrate to provide a coated substrate.

Subject cont.

15. The method of claim 14 further comprising subjecting the coated substrate to UV radiation to provide a UV cured coated substrate.

16. The method of claim 15 further comprising subjecting the UV cured coated substrate to heat to provide a UV and thermally cured coated substrate.

17. The method of claim 14 wherein the substrate comprises a plastic.

18. The method of claim 17 wherein the plastic substrate is a fiber-reinforced plastic substrate.

19. The method of claim 17 wherein the plastic substrate is SMC or BMC.

20. The method of claim 15 wherein the UV cured coated substrate is coated with one or more coating compositions to provide a coated UV cured coated substrate.

21. The method of claim 16 wherein the UV and thermally cured coated substrate is coated with one or more coating compositions to provide a coated UV and thermally cured coated substrate

22. The method of claim 20 wherein the UV and thermally cured coated substrate is coated with at least one basecoat coating composition.

23. The method of claim 20 wherein the UV and thermally cured coated substrate is coated with at least one clearcoat coating composition.

24. The method of claim 21 wherein the coated UV and thermally cured coated substrate is substantially free of surface defects resulting from vaporous substrate emissions.

25. A coated substrate made by the method of claim 14.